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**AMENDMENTS TO THE DRAWINGS**

The attached sheet of drawings includes:

New FIGS. 1C, 2C, 2D, and 5.

**Attachments:**

4 Replacement Sheets

4 Annotated Sheets Showing Changes

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### **REMARKS**

Applicant thanks the Examiner for the thoughtful review of the application. The status of the claims is as follows: **Claims 1 – 45 are Pending** in the present application. **Claims 1, 10, 15, 23, 25, 33, 43, and 44** have been **Amended** herein and **Claim 3** has been **Canceled**. Amendments to the claims are described below in the **PRESENT AMENDMENT**.

#### **i. PRESENT AMENDMENT**

Independent **Claims 1, 25, 33, and 44** and dependent **Claim 10** were amended herein to recite that a multi-resistive state element includes at least two conductive metal oxide layers that are either not identical to each other (**Claims 1 and 10**) or are at least slightly different from each other (**Claims 25, 33, and 44**). Support can at least be found in Paragraph 0033 of the **Detailed Description** which incorporates by reference in its entirety for all purposes, co-pending U.S. Application No. **10/605,757** (see Paragraphs **0071 – 0082** and **FIG. 9** of Application No. **10/605,757**, which Examiner Tu V Ho has also Examined).

**Claim 3** was **Canceled** because the recitation of a conductive metal oxide was amended into independent **Claim 1** from which it depends. Consequently, the rejections of **Claim 3** are now mooted by its cancellation.

**Claim 15** was amended to depend from **Claim 10** instead of **Claim 1**, thereby overcoming the Examiners objection to the improper dependency of **Claim 15**.

**Claim 23** was amended to recite that the interconnect metal layers are positioned above the bottom refractory metal layer and not the top metal layer. Support can at least be found in new **FIG. 1C** of the **Drawings** and accompanying text.

**Claim 43** was amended to delete "a multi-resistive state material" because independent **Claim 33** as amended now includes "a multi-resistive state element".

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No new matter was introduced in amending the claims.

New drawings have been added to address the Examiner's objections to claim 10, 11, 14, 22, 23, 32, 38, 39 and 43. The drawings can be found in the following applications: Ser. No. 10/360,005, filed February 7, 2003, and published as 20040160819 on August 19, 2004; Ser. No. 10/605,757 filed October 23, 2003, and published as 20040159867 on August 19, 2004; and Ser. No. 10/682,277 filed October 8, 2003, and published as 20040159868 on August 19, 2004. Since each of these applications were properly incorporated by reference in the original disclosure, no new matter is being added by the new drawings. The primary difference in the drawings being presented and the drawings accompanying the above applications is different reference numerals.

Amendments to the specification accompanying the added drawings have also been added. The added paragraphs were taken from the above applications, with only minor edits, primarily to account for readability and the re-numbered reference numerals. For the Examiner's convenience, an Appendix is attached to this Amendment that clearly shows the original text (as published) and the modifications that were made. No new matter is being added by the present amendment to the specification.

ii. **ARGUMENT**

a. **Objection to Claim 15**

The objection to Claim 15 as improperly depending from Claim 1 instead of Claim 10 is now mooted by the amendment to Claim 15 as set forth above. Claim 15 as amended now depends from Claim 10. Consequently, the objection to Claim 15 ought to now be withdrawn.

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**b. Rejection of Claims 25 – 29 under 35 U.S.C. §102(e) (801 Patent)**

The *Slaughter* reference does not explicitly or inherently describe a multi-resistive state element that includes at least two conductive metal oxide layers that are not identical to each other or are at least slightly different from each other. Instead, what *Slaughter* discloses is a magnetic tunnel junction memory cell (MJT) that includes layers of magnetic materials that are separated by a thin dielectric tunnel barrier layer as is well understood in the MRAM art (see the Abstract of *Slaughter*). Moreover, the Applicant respectfully submits that the layers of Fig. 5 (24, 25, 27, & 28) and the layers of Fig. 6 (56, 58, 60, 62, & 66) of *Slaughter* are multiple ferromagnetic layers of material, and are not the conductive metal oxides as currently recited in Claim 25 of the present application. See for example, Col. 2, lines 1 – 40 and Fig. 1, Col. 3, lines 11 – 19, and Col. 7, lines 44 – 51 of *Slaughter*.

The multiple ferromagnetic layers of material and the tunnel barrier layer in *Slaughter* store data based on the physics of magnetoresistance (MR) and the state of the vectors (16, 17) is changed by a magnetic field generated by current flowing through the electrodes (22, 29) and (54, 68) of Figs. 5 and 6 respectively. In sharp contrast, in Claim 25, data is stored as a resistance that changes based on a magnitude and a polarity of voltage pulses applied to the top and bottom electrodes. The state of the data is determined by a magnitude of a resistance of the multi-resistive state element and that magnitude can be determined by applying a potential difference across the top and bottom electrodes and measuring a current flow through the multi-resistive state element.

Consequently, Claim 25 is not anticipated by the cited sections of *Slaughter* and the rejection of Claim 25 under 35 U.S.C. §102(e) ought to now be withdrawn. Claims 26 – 29 depend from Claim 25 and inherit all of its limitations. Therefore, Claims 26 – 29 are not anticipated by the cited sections of *Slaughter* and the rejection of Claims 26 – 29 under 35 U.S.C. §102(e) ought to now be withdrawn.

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**c. Rejection of Claims 1 – 6, 8 – 9, 25 – 27, 33 – 35, 37, and 44 under 35 U.S.C. §102(e) and 35 U.S.C. §103(a) (821 Patent)**

For the same reasons as argued above for the §102(e) rejection of independent Claim 25, independent Claims 1, 25, 33, and 44 are not anticipated under §102(e) and are not §103(a) obvious in view of *Hsu* for the following reasons. First, under §102(e), *Hsu* does not explicitly or inherently describe a multi-resistive state element that includes at least two conductive metal oxide layers that are not identical to each other or are at least slightly different from each other as is now claimed in the above rejected independent claims. In sharp contrast, *Hsu* expressly discloses a single layer of a perovskite material 17 (see Figs. 2, 3, 4, 5, and 6) that comprises what the Examiner refers to as a multi-state resistive element 22. In Col. 6, lines 16, 28 – 34, 43 – 54, *Hsu* explicitly states that a single layer of a colossal magnetoresistance material (CMR) (e.g. PCMO) is used. Therefore, the a multi-resistive state element that includes at least two conductive metal oxide layers that are not identical to each other or are at least slightly different from each other as now recited in independent Claims 1, 25, 33, and 44 are not explicitly or inherently found in *Hsu* and the rejection of those claims under 35 U.S.C. §102(e) ought to now be withdrawn. Moreover, because dependent Claims 2 – 6, 8 – 9, 26 – 27, 34 – 35, and 37 depend from the aforementioned independent claims, those dependent claims are not anticipated under 35 U.S.C. §102(e) in view of *Hsu* and the rejection of those dependent claims ought to now be withdrawn.

As for the rejection of Claims 1 – 6, 8 – 9, 25 – 27, 33 – 35, 37, and 44 under 35 U.S.C. §103(a), a prima facie case of obviousness under §103(a) cannot stand if the reference is silent and/or teaches away from the claimed subject matter of the rejected claims. Clearly, *Hsu* is silent as to using a multi-resistive state element that includes at least two conductive metal oxide layers that are not identical to each other or are at least slightly different from each other to form the multi-state resistive element 22 of Fig. 5. Moreover, *Hsu* teaches away from a multi-resistive state element that includes at least two conductive metal oxide layers that are not identical to each other or are at least slightly different from each other because *Hsu* expressly teaches (Col. 6, lines 16, 28 – 34, 43 – 54) and shows (Figs. 2 – 5) a single layer of the CMR material.

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Therefore, independent **Claims 1, 25, 33, and 44** and dependent **Claims 2 – 6, 8 – 9, 26 – 27, 34 – 35, and 37** are not **§103(a)** obvious in view of *Hsu* and the rejection of those claims ought to now be withdrawn.

**d. Rejection of Claims 1 – 4, 8 – 9, 24 – 25, and 44 under 35 U.S.C. §102(e) and 35 U.S.C. §103(a) (745 Patent)**

Independent **Claims 1, 25, and 44** are not anticipated under **§102(e)** because *Hsu* does not explicitly or inherently disclose a multi-resistive state element that includes at least two conductive metal oxide layers that are not identical to each other or are at least slightly different from each other. A close review of all four corner of *Hsu* will clearly show that in Figs. 1 – 11, a plurality of bit lines 18, a plurality of top word lines 22, and a plurality of bottom word lines 14 are in communication with two separate and distinct layers that are made from identical perovskite (CMR) materials (29, 25). See for example, Figs. 4 – 6 and Col. 1, lines 40 – 64, Col. 3, lines 11 – 57, and Col. 5, claims 1 and 6, and Col. 6, claims 7, 8, 13, & 17 – 19.

Each layer of the perovskite material (29, 25) forms a separate bit that shares a common bit line 18 so that two separate bits (i.e. separate memory elements) can be accessed via the bit lines 18, and one of the top word lines or one of the bottom word lines. Essentially, the structure of *Hsu* allows a density of the memory device to be doubled. However, the perovskite material (29, 25) is a single layer and the material is the same for both layers (see the aforementioned claims) and those materials are not described as being at least slightly different from each other.

Independent **Claims 1, 25, and 44** are not anticipated under **§102(e)** because each and every limitation as now recited in those claims is not explicitly or inherently disclosed in *Hsu*. Therefore, the rejection of those claims under **35 U.S.C. §102(e)** ought to now be withdrawn. Similarly, because dependent **Claims 2 – 4, 8 – 9, and 24** depend from independent **Claim 1** and inherit all of its limitations, those dependent claims are not anticipated by *Hsu*. Consequently, the rejection of those claims under **35 U.S.C. §102(e)** ought to now be withdrawn.

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For the same reasons as argued above for anticipation by *Hsu*, **Claims 1 – 4, 8 – 9, 24 – 25, and 44** are not §103(a) obvious because *Hsu* is silent and teaches away from a multi-resistive state element that includes at least two conductive metal oxide layers that are not identical to each other or are at least slightly different from each other. Therefore, the rejections of **Claims 1 – 4, 8 – 9, 24 – 25, and 44** under 35 U.S.C. §103(a) ought to now be withdrawn.

**e. Rejection of Claims 1 – 4, 8 – 9, 24 – 25, and 44 under 35 U.S.C. §102(e) and 35 U.S.C. §103(a) (332 Patent)**

*Ignatiev* is also silent as to a multi-resistive state element that includes at least two conductive metal oxide layers that are not identical to each other or are at least slightly different from each other. In Figs. 1 and 2, Col. 7, lines 17 – 23, and lines 47 – 63, Col. 8, lines 2 – 25, and claims 1, 7, 10, 16, 28, 33, and 36, the multi-valued, resistive memory material is disclosed as being a single layer only. However, that single layer can include a mixture of CMR materials. In sharp contrast, the at least two conductive metal oxide layers of the present application are separate layers and those layers are either not identical to each other or are at least slightly different from each other. No where in the four corners of *Ignatiev* is the structure of **Claims 1 – 4, 8 – 9, 24 – 25, and 44** explicitly or inherently disclosed. Therefore the rejection of **Claims 1 – 4, 8 – 9, 24 – 25, and 44** under 35 U.S.C. §102(e) ought to now be withdrawn.

In Figs. 1 and 2 and in the aforementioned columns, *Ignatiev* is silent as to at least two conductive metal oxide layers and to those layers being not identical to each other or at least slightly different from each other. Moreover, *Ignatiev* teaches away from at least two layers in Figs. 1 and 2 where only a single layer 110 or 208 is disclosed. Therefore, a prima facie case of obviousness has not been met and the rejection of **Claims 1 – 4, 8 – 9, 24 – 25, and 44** under 35 U.S.C. §103(a) ought to now be withdrawn.

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**f. Rejection of Claims 1 – 2, 4, and 33 under 35 U.S.C. §102(b) and 35 U.S.C. §103(a) (882 Patent)**

The *Johnson* reference does not anticipate **Claims 1 – 2, 4, and 33 under 35 U.S.C. §102(b)** because *Johnson* does not explicitly or inherently disclose a multi-resistive state element that includes at least two conductive metal oxide layers that are not identical to each other or are at least slightly different from each other. For example, in Figs. 4a – 5, Col. 5, lines 40 – 65, and Col. 8, lines 34 – 67, the state change element 23 is not disclosed as including at least two conductive metal oxide layers. For a prima facie rejection under **§102(b)** to stand, *Johnson* must disclose the structure as set forth in the rejected claims. *Johnson*, in Col. 8, lines 34 – 67, gives a long list of candidates for the state change element 23 and concludes that list with “others”. However, “others” does not explicitly or inherently disclose the structure of the rejected claims. Therefore, *Johnson* does not anticipate **Claims 1 – 2, 4, and 33 under 35 U.S.C. §102(b)** and the rejection of those claims ought to now be withdrawn.

Similarly, under **35 U.S.C. §103(a)**, *Johnson* is silent as to at least two layers of a conductive metal oxide and in Figs. 4a – 5 teaches away from at least two layers by disclosing a single layer for the state change element 23. Therefore, **Claims 1 – 2, 4, and 33** are not **§103(a)** obvious in view of *Johnson* and the rejection of those claims ought to now be withdrawn.

**g. Rejection of Claim 7 under 35 U.S.C. §103(a) (821 Patent)**

In the rejection, the Examiner contends that even though *Hsu* does not disclose that bottom refractory metal layer is tungsten, molybdenum or tantalum, the platinum top and bottom electrodes of *Hsu* are refractory metals and therefore one skilled in the art upon reading *Hsu* would consider tungsten, molybdenum or tantalum to be the equivalent of platinum. First, the Applicant does not adopt the Examiner contention that platinum is a refractory metal. In fact, platinum is classified as a precious metal and tungsten, molybdenum and tantalum are classified as refractory metals. Second, as argued above, **Claim 7** inherits all of the limitations of independent **Claim 1** and the



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disclosure of *Hsu* is silent and teaches away from the limitations of a multi-resistive state element that includes at least two conductive metal oxide layers that are not identical to each other or are at least slightly different from each other. Consequently, **Claim 7** is not §103(a) obvious in view of *Hsu* and the rejection of **Claim 7** ought to now be withdrawn.

**h. Rejection of Claim 44 under 35 U.S.C. §103(a) (745 & 652 Patents)**

The combination of *Hsu* and *Furukawa* would not lead one of ordinary skill in the art to arrive at the process steps now claimed in **Claim 44**. As argued above, *Hsu* is silent and teaches away from forming a multi-resistive state layer in which the multi-resistive state element includes at least two conductive metal oxide layers that are at least slightly different from each other. Furthermore, a reading of *Furukawa* would not provide a motivation to arrive at **Claim 44** in view of what is disclosed by *Hsu*. Therefore, **Claim 44** is not §103(a) prima facie obvious in view of *Hsu* and *Furukawa* taken individually or in combination. Accordingly, the rejection of **Claim 44** under 35 U.S.C. §103(a) ought to now be withdrawn.

**i. Rejection of Claim 32 under 35 U.S.C. §103(a) (745 & 301 Patents)**

For the same reasons as argued above for *Hsu*, **Claim 32** is not §103(a) prima facie obvious in view of *Hsu* and *Thomas* taken individually or in combination because neither reference would provide a roadmap to one of ordinary skill in the art to arrive at the structure of independent **Claim 25** from which **Claim 32** depends. Namely, the multi-resistive state element includes at least two conductive metal oxide layers that are at least slightly different from each other. Specifically, *Hsu* is both silent and teaches away from the at least two conductive metal oxide layers and the combined teachings of *Thomas* and *Hsu* are both silent and teach away from the at least two conductive metal oxide layers. Consequently, **Claim 32** is not §103(a) prima facie obvious in view of *Hsu* and *Thomas* and the rejection of **Claim 32** under 35 U.S.C. §103(a) ought to now be withdrawn.

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j. **Rejection of Claim 45 under 35 U.S.C. §103(a) (745, 301, & 652 Patents)**

For the same reasons as argued above for the rejection of Claim 44 under 35 U.S.C. §103(a) in view of *Hsu* and *Furukawa*, the addition of the *Thomas* reference would not lead one skilled in the art to arrive at the structure recited in amended Claim 1 from which Claim 45 indirectly depends. Therefore, Claim 45 is not §103(a) obvious in view of *Hsu*, *Furukawa*, and *Thomas* and the rejection of Claim 45 under 35 U.S.C. §103(a) ought to now be withdrawn.

k. **Rejection of Claims 24 and 45 under 35 U.S.C. §103(a) (332 Patent and the 902 Publication)**

The combination of *Ignatiev* and *Perner* would not lead one skilled in the art to arrive at the structure of independent Claim 1 from which Claims 24 and 45 depend. As argued above, *Ignatiev* teaches away from and is silent as to at least two layers of conductive metal oxides and where those conductive metal oxides are not identical to each other or are at least slightly different from each other. Furthermore, *Perner* in Figs. 4 and 5, the Abstract, and in paragraphs 0022 – 0026, discloses a MRAM memory cell in which the layers of material are ferromagnetic layers. *Perner* is silent as to substituting the ferromagnetic layers that are required for a magnetic field controlled memory device and replacing those layers with the voltage controlled multi-resistive state element of the present application. Therefore, Claims 24 and 45 are not §103(a) obvious in view of *Hsu* and *Perner* and the rejections of Claims 24 and 45 under 35 U.S.C. §103(a) ought to now be withdrawn.

iii. **CONCLUSION**

Applicant now believes the present case to be in condition for allowance, and respectfully requests a Notice of Allowance for this application from the Examiner.

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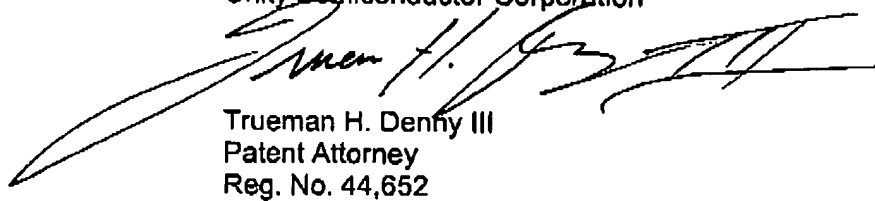
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Should the Examiner believe that a telephone conference would expedite the prosecution of this application the undersigned can be reached at (408) 737-7200 x124.

Respectfully submitted,  
Unity Semiconductor Corporation

A handwritten signature in black ink, appearing to read "Trueman H. Denhy III", is written over the typed name and title.

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